1994 MONITORING REPORT:
BRUNEAU HOT-SPRING SPRINGSNAIL
(*PYRGULOPSIS BRUNEAUENSIS*)

by
Jeffrey T. Varricchione
G. Wayne Minshall

A mobile home doesn't guarantee a place to live.
(The Nature Conservancy)

IDAHO BUREAU OF LAND MANAGEMENT TECHNICAL BULLETIN NO. 95-14 JUNE 1995

ANNUAL MONITORING REPORT

Bruneau Hot-spring Springsnail (*Pyrgulopsis bruneauensis*)

Jeffrey T. Varricchione and G. Wayne Minshall

Stream Ecology Center
Department of Biological Sciences
Idaho State University
Pocatello, Idaho 83209

31 December 1994

Table of Contents

List of Figures

SUMMARY

This report presents the 1994 monitoring results from four sites near the Indian Bathtub that contain populations of the Bruneau Hot-spring Springsnail (*Pyrgulopsis bruneauensis*). Three of these sites were monitored in 1990 and 1991 by Mladenka (1992), in 1992 by Robinson et al. (1992), and in 1993 by Royer and Minshall (1993). An additional seep at Site 3 was included in the 1994 monitoring efforts.

Populations were reduced drastically in Hot Creek (Site 1) by a major runoff event in July 1992 and have since failed to recover (Royer and Minshall 1993). Sites 2 and 3 appeared to have maintained population densities similar to those in previous years, with fluctuations being mainly attributable to seasonality of temperature. Site 3 (New Seep) maintained a highly variable population density. Temperatures were stable at sites 1 and 2. Temperatures at Site 3 were often below 24°C and may potentially affect local snail reproductive success.

INTRODUCTION

The Springsnail (*Pyrgulopsis bruneauensis*) is an endemic species inhabiting a complex of related hot springs near the Bruneau River south of Mountain Home, Idaho. The snail's habitat has diminished considerably in recent years because of agricultural-related groundwater mining in the area. As a consequence, the snail was listed as an endangered species in 1993. Legal actions in 1994 removed the snail from the list.

Hershler (1990) provided a complete taxonomic description of *P. bruneauensis*. Mladenka (1992) focused on the life history of *P. bruneauensis*, providing the groundwork on which this monitoring study is based. Mladenka (1992) found only two studies addressing the biology of *P. bruneauensis*; Taylor (1982) described the taxonomy of the snail, and Fritchman (1985) studied its reproduction in the laboratory.

Mladenka (1992) found temperature to be important in the distribution of *P. bruneauensis*, with reproduction possible at temperatures between 24° - 35°C. Snail growth was retarded at cooler temperatures (<24°C). In addition, he showed sexual maturity to occur in two months; the sex ratio was 1:1. The snails showed little preference for current or substrata type. Mladenka (1992) noted that the snail population may have declined by 50% from earlier estimates of abundance, and by 100% in local areas such as the Indian Bathtub. This report presents the continued biomonitoring of Mladenka's (1992) study sites through November 1994.

RESULTS

Size Distribution

Snail size structure was monitored at the three study sites: Site 1 (Hot Creek), Site 2 (Upper Spring Rockface), and Site 3 (Lower Spring Rockface) (Mladenka 1992). As suggested by Royer and Minshall (1993), a new seep at the southern edge of Site 3 was included in the monitoring for 1994. Figures 1a-e illustrate the monthly size distributions for Sites 1, 2, and 3 (original and New Seep) since 16 February 1990. Snails smaller than 1 mm in size were arbitrarily designated as juveniles.

Site 1 (Hot Creek)

Site 1 (Hot Creek) population was reduced to nearly zero in July 1992 and has yet to recover by November 1994. Thus, no snails were present for size measurements.

Site 2 (Upper Spring Rockface)

This population maintained a relatively constant size structure through most of the years (Fig. 1a-e). Populations early in 1993 (Fig. 1d) and early in 1994 (Fig. 1e) were skewed towards the juvenile size classes. For the remainder of 1994,

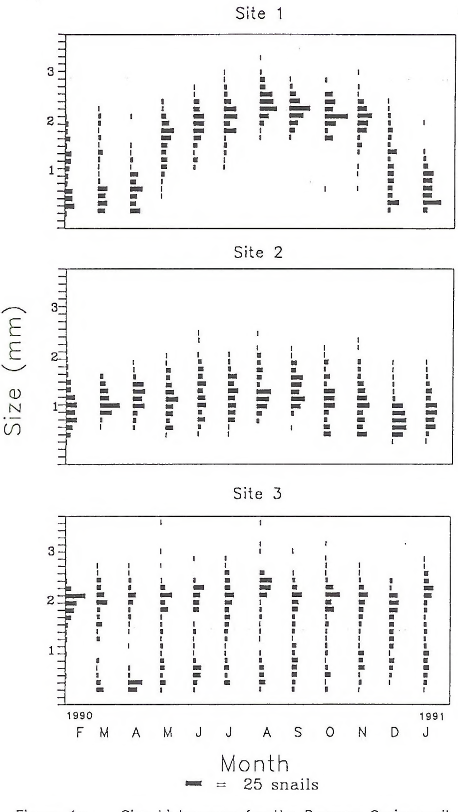

Figure 1a. Size histograms for the Bruneau Springsnail study sites. Horizontal tick marks represent 0.14mm size classes (n=100 for each sample).

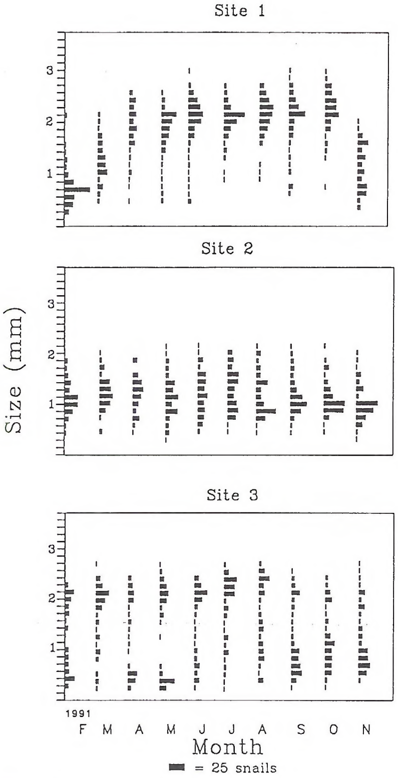

Figure 1b. Size histograms for the Bruneau Springsnail study sites. Horizontal tick marks represent 0.14mm size classes (n=100 for each sample).

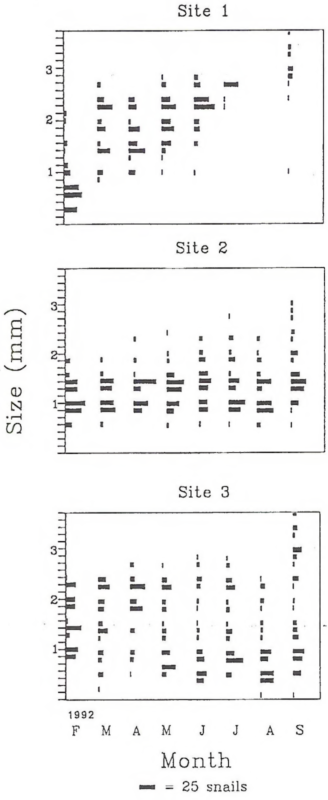

Figure 1c. Size histograms for the Bruneau Springsnail study sites. Horizontal tick marks represent 0.14mm size classes (n=100 for each sample).

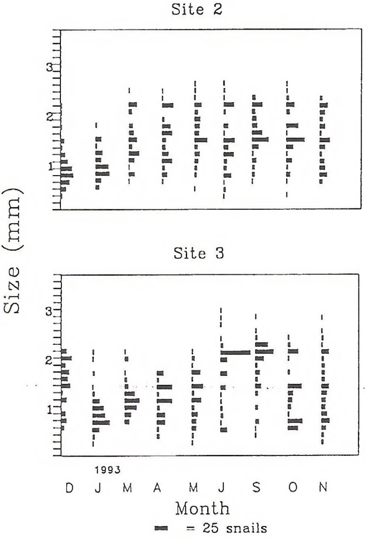

Figure 1d. Size histograms for the Bruneau Springsnail study sites. Horizontal tick marks represent 0.14mm size classess (n=100 for each sample).

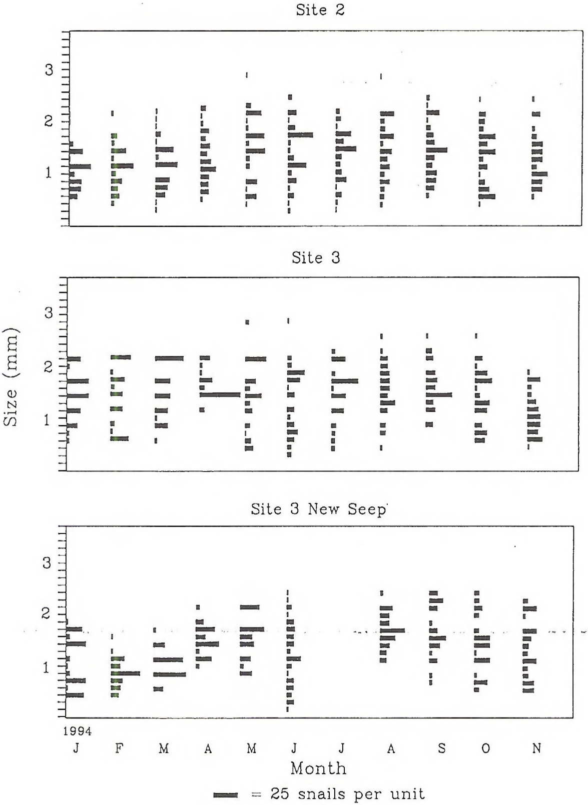

Figure 1e. Size histograms for the Bruneau Springsnail study sites.. Horizontal tick marks represent 0.14mm size classes (n=100 for each sample).

snails were evenly distributed between the 0.5 mm and 2.0 mm size classes. Juvenile recruitment appeared to be relatively constant (Fig 1e). Data for 1993 and 1994 revealed an absence of adults in the 2 to 3 mm size classes, contrary to data from previous years (Fig. 1a-e).

Site 3 (Lower Spring Rockface)

The snail population at Site 3 displayed a bimodal distribution until January 1993 (Fig. 1a-d). For 1994, the population displayed a relatively even distribution across the 0.5 mm to 2.0 mm size classes (Fig. 1e). Most recruitment occurred duringthe months of January through March, May through July, and October (Fig. 1e). Snails larger than 2.0mm had been recorded in greater densities during the summer months of 1993 (Fig. 1d) than during the summer months of 1994 (Fig. 1e).

Site 3 (New Seep)

The snail population at the New Seep in early 1994 was comprised primarily of juvenile size classes (Fig 1e). As the year progressed, the population became more evenly distributed, ranging in sizes between 0.5 and 2.0 mm. April and August, having low proportions of juvenile snails, were exceptions to this pattern (Fig. 1e).

Although minute between-site differences were recorded in February, March, May, and August, size distributions at Site 3 (New Seep) generally mirrored size distributions at Site 3 (Lower Spring Rockface) (Fig. 1e).

Population Fluctuations

Site 1 (Hot Creek)

Storm flow in Hot Creek during July 1992 resulted in major channel scouring and sediment loading. The Indian Bathtub was

completely filled with sediment. The Hot Creek population of *P. bruneauensis* was reduced to nearly zero as a result (Robinson et al. 1992). No snails were found in Hot Creek in 1993 nor in 1994. It is likely that *P. bruneauensis* has been extirpated from this site (Fig. 2) (Royer and Minshall 1993). A stream side refugia that had retained snails (<10 individuals) in the past (Robinson et al. 1992) continued to do so in 1993. Royer and Minshall (1993) noted that in May 1993 this refugia became overgrown with dense terrestrial vegetation which has persisted through November 1994, preventing observations in 1993 and in 1994.

Site 2 (Upper Spring Rockface)

The snail population at Site 2 in 1994 had densities similar to those found in the early months of previous years (Fig. 2). The largest density for 1994 was 8114 snails/m^2 in May. As in previous years, the population decreased with the onset of autumn to reach the year's lowest density of 1365 snails/m^2 (see November 1994 in Fig. 2). This agreed with previous monitoring results where densities were greater in the spring than in the autumn. Given adequate water flow, the population of *P. bruneauensis* at Site 2 should remain viable.

Site 3 (Lower Spring Rockface)

Royer and Minshall (1993) found increases in snail density (and an associated increase in spatial variability) due to the inclusion of a new seep at Site 3 in population estimates (Fig. 2). At their suggestion, these sites have been monitored separately in order to distinguish differential population fluctuations occurring over-time.

The snail population at the original Site 3 increased from 1435 snails/m^2 in March 1994 to 5432 snails/m^2 in September. As autumn progressed, lower snail densities were recorded. The rockface at Site 3 (original seep) maintained a thick moss/periphyton matrix. This complex appeared to inhibit snails

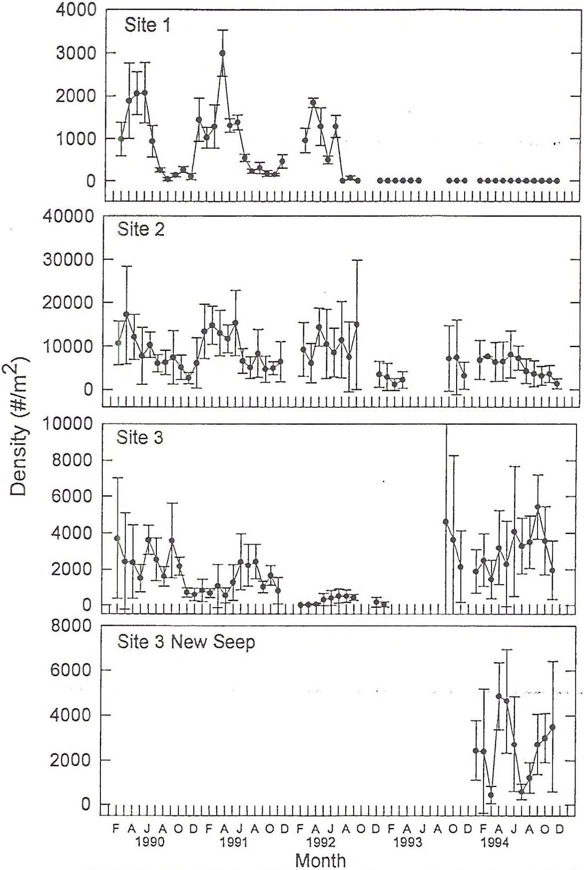

Figure 2. Mean density of the Bruneau Springsnail at the four study sites. Error bars represent one standard deviation from the mean. Note the different Y-axes for each site.

from inhabiting these rockfaces, although a few snails were observed. The rockface area covered by this complex was not included in density monitoring efforts.

Water temperatures at Site 3 (original seep) tended to be low and the rockface completely froze over during the 1991/1992 winter (Robinson et al. 1992) and 1992/1993 winter (Royer and Minshall 1993). Ice also formed during the 1993/1994 winter. Fluctuations in density were probably a response to changes in temperature. To potentially increase the *P. bruneauensis* population at Site 3, enhanced water flow, sufficient to maintain optimal temperature and habitat conditions, is neccessary.

Site 3 (New Seep)

Snail populations at Site 3 (New Seep) varied greatly in 1994 (Fig. 2). The lowest density, 428 snails/m^2, was recorded in March and the highest density, 4861 snails/m^2, in April. Site 3 (New Seep) does not provide a substantial area suitable for snail growth because of shading, low groundwater flow, and the presence of an orange moss/periphyton complex on certain locations of the rockface.

Temperature And Water Chemistry Fluctuations

Because of problems associated with using maximum/minimum thermometers (i.e. breakage, theft, size), miniature temperature data loggers were used at all sites in 1994. Internal sensor loggers (Onset Hobo-Temp HTI-05+37) were used from 18 February 1994 to 26 September 1994, and then were replaced with external sensor data loggers (Onset StowAway-Temp STEB02-05+37) on 26 September 1994.

Site 1 (Hot Creek)

Following channel scouring and sediment loading in July 1992, the discharge of Hot Creek was dramatically reduced (Fig. 3).

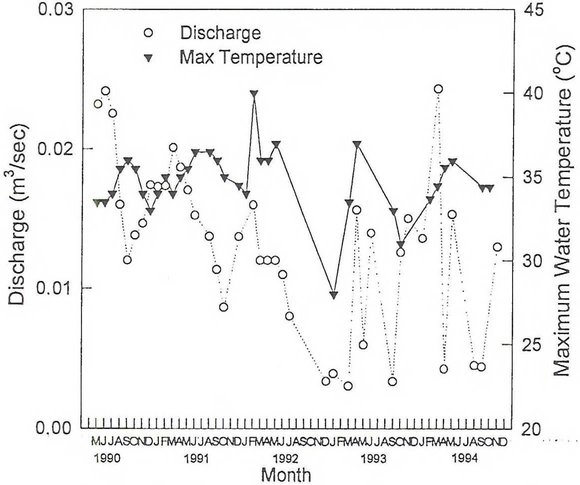

Figure 3. Discharge and maximum water temperatures for Site 1 (Hot Creek).

Discharge fluctuated greatly during both 1993 and 1994, most likely a result of precipitation (Fig. 3). In general, reduced discharge in Hot Creek resulted in higher maximum water temperatures (Mladenka 1992). This relationship did not hold as strongly for 1993 and 1994 as in previous years (Fig. 3). In 1994, both minimum (31°C) and maximum temperatures (36°C) were recorded in May (Fig. 4). This probably occurred because the top of the temperature logger case (internal sensor) had been exposed to the air in May. There was no significant change in water chemistry at Site 1 during 1993 (Fig. 5).

Site 2

Site 2 had relatively constant temperatures during 1994 (Fig. 4). Minimum temperatures (30°) were recorded in mid-February, mid-March, and early July. Maximum temperatures (34°) were measured between April to October. Temperature variation was minimal during October. There was no significant change in water chemistry from previous years (Fig. 5).

Site 3

Site 3 displayed the greatest variation in temperature among the monitoring sites. There was often a lack of adequate water flow in which to effectively place the data logger. External sensor data (beginning 26 September 1994) appeared to be more precise and should offer more accurate measurements in future monitoring. Water temperatures ranged from 17°C in February to 32°C in July 1994. It is probable that snails were restricted to certain habitats at this site because of low temperatures and the formation of ice on the rockface during winter.

Periphyton Levels

Site 1 (Hot Creek)

In 1994, chlorophyll a and ash-free dry mass (AFDM) of

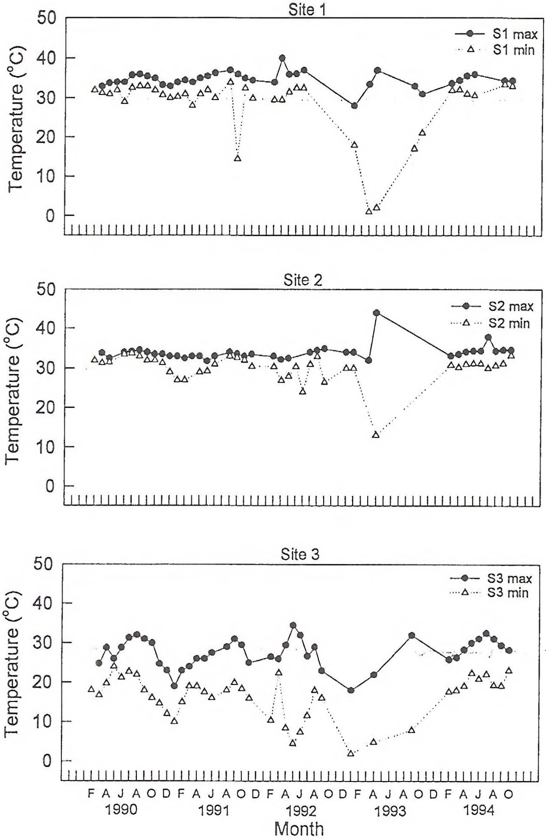

Figure 4. Maximum and minimum water temperatures for the Bruneau Hot Springs study sites.

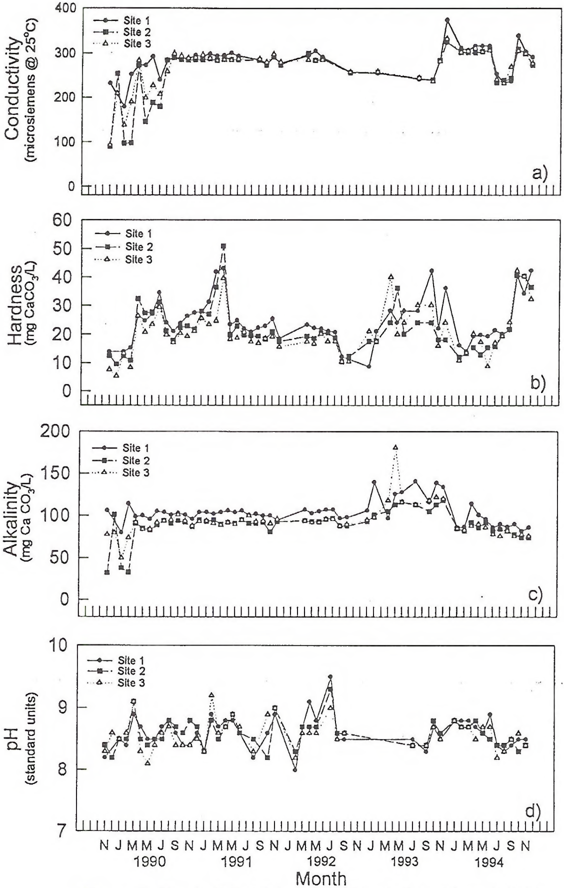

Figure 5. Conductivity (a), hardness (b), alkalinity (c), and pH (d) for the Bruneau Hot Springs study sites.

periphyton decreased substantially from values observed in 1993 (Figs. 6, 7). Prior to 1992, chlorophyll a levels at Site 1 typically peaked during summer and decreased in winter (Fig. 6), and the high summer values corresponded with decreased snail abundance. It is likely that the high chlorophyll a and AFDM values observed in 1993 resulted from the absence of *P. bruneauensis* in Hot Creek (Royer and Minshall 1993). In 1994, chlorophyll a and AFDM peaked in the late spring, as in years prior to 1993. Low chlorophyll a values in 1994 potentially could be attributed to the presence of the Hot Creek guppy *Gambusia*.

Site 2 (Upper Spring Rockface)

Chlorophyll a and AFMD values were lower in 1994 than values recorded in 1993 (Fig. 6, 7). Values were greatest during the spring and decreased in late summer and autumn. This data is similar to values recorded in 1991.

Site 3 (Lower Spring Rockface)

Chlorophyll a and AFDM values were slightly lower in 1994 than in 1993 (Fig. 6, 7). Values were greatest during spring months and dropped as late summer and fall approached. This trend is consistent with data from 1990 and 1991.

Site 3 (New Seep)

Chlorophyll a and AFDM values were highest in spring and lowest in the autumn. Values were lower than those found at the original Site 3, probably because of greater shading by terrestrial vegetation and rock outcrops.

Conditions At Indian Bathtub And Hot Creek

A flood in the summer of 1991 contributed much silt, sand,

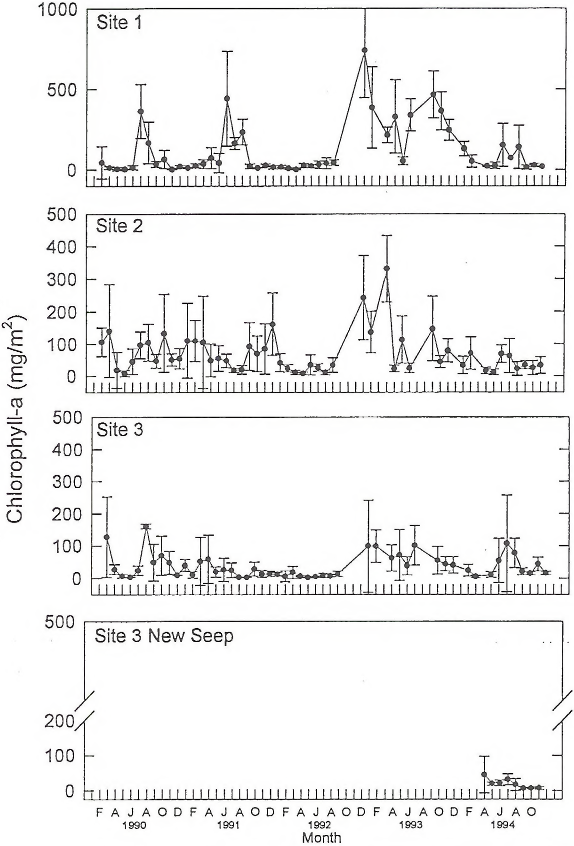

Figure 6. Chlorophyll-a values for the Bruneau Springsnail study sites. Error bars represent one standard deviation from the mean. (n=5 for Sites 1 and 2; n=3 for Site 3 and n=2 for Site 3 New Seep).

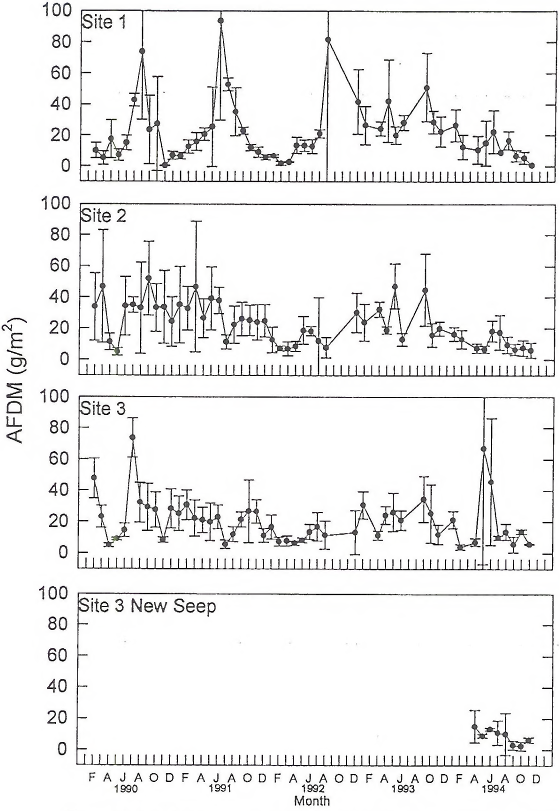

Figure 7. Ash-free dry mass (AFDM) values for the Bruneau Springsnail study sites. Error bars represent one standard deviation from the mean. (n=5 for Sites 1 and 2; n=3 for Site 3 and n=2 for Site 3 New Seep).

and gravel to Hot Creek. In particular, Indian Bathtub was reduced to less than one-half its size before the flood because of sediment addition. Available habitat in the immediate vicinity of Indian Bathtub was reduced because of this and other sedimentation events. Another flood occurred in July 1992 which substantially altered and scoured the channel of Hot Creek. This event completely filled in the remainder of Indian Bathtub. Due to these events, it appears that *P. bruneauensis* has been extirpated from Indian Bathtub and Hot Creek (Royer and Minshall 1993).

Investigations into the effects of the Hot Creek guppy *Gambusia* in 1995 should lend insight into the probability of recovery of the Springsnail in Hot Creek. However, the data that have been collected to date indicate that immediate measures should be taken to rehabilitate the Indian Bathtub area and restore the habitat conditions to at least those found prior to July 1992. This is the minimum effort required to restore the Bruneau Hot-spring Springsnail to Hot Creek. Habitat restoration would enable us to determine if the snail will repopulate naturally or whether transplantation may be necessary.

ACKNOWLEDGEMENTS

Many thanks to Chris Robinson for helpful comments on the report. Thanks also to Todd Royer, Linden Schlenker, Jim Clark, Jeri William, and Cori Lyons for field assistance during the hot summer months.

LITERATURE CITED

Fritchman, H. K. 1985. The Bruneau hot spring snail: an unidentified, possibly endangered hydrobiid from Hot Creek and the Indian Bathtub, Owyhee Co., Idaho. Remarks on its biology. Unpublished report.

Hershler, R. 1990. *Pyrgulopsis bruneauensis*, a new springsnail (Gastropoda: Hydrobiidae) from the Snake River Plain, southern Idaho. Proc. Biol. Soc. Wash. 103: 803-814.

Mladenka, G. C. 1992. The ecological life history of the Bruneau hot springs snail (*Pyrgulopsis bruneauensis*). Unpublished M.Sc. Thesis, Idaho State University, Pocatello, Idaho.

Ponder, W. F., R. Hershler, and B. Jenkins. 1989. An endemic radiation of hydrobiid snails from artesian springs in northern South Australia: their taxonomy, physiology, distribution, and anatomy. Malacologia 31:1-140.

Robinson, C. T., G. W. Minshall, and K. Sant. 1992. Annual Monitoring Report: Bruneau Hot Springs Snail (*Pyrgulopsis bruneauensis*). Prepared for the U.S. Bureau of Land Management, Boise, ID.

Royer, T. V. and G. W. Minshall. 1993. Annual Monitoring Report: Bruneau Hot Springsnail (*Pyrgulopsis bruneauensis*). Prepared for the U.S. Bureau of Land Management, Boise, ID.

Taylor, D. W. 1982. Status report on the Bruneau hot springs snail. Conducted for the U.S. Fish and Wildlife Service, Boise Office, Idaho.